

# The Status of Sandalwood (*S. macgregorii*) in Papua New Guinea<sup>1</sup>

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**Abstract:** *Santalum macgregorii* grows between 100 and 1500 m and is not evenly distributed throughout the country. It grows only around the central province where savannahs are found. Most of this original *S. macgregorii* stand was harvested during 1890-1910 and again in 1933. The government of Papua New Guinea does not have a stand of sandalwood. Any remains of *S. macgregorii* are owned and harvested by the landowners. Landowners then sell the graded logs to agents in Port Moresby, who in turn sell them to buyers in Hong Kong, Singapore, Taiwan, and Japan. Studies including phenology, silviculture, and growth of *S. macgregorii* are yet to be established.

Papua New Guinea lies in the southwestern part of the Pacific Ocean and covers a land area of 461,700 square kilometers between latitude 0° and 12°S and longitude 141° and 156°E. The country consists of the eastern half of the Island of New Guinea; the Trobriand, Woodlark, d'Entrecasteaux and Loursiade groups of Islands; the Bismarck Archipelago with New Britain, New Ireland, Manus; and the Buka and the Bougainville Islands of the Solomons.

The central part of Papua New Guinea is a massive mountain chain with peaks exceeding 4500 m (Mount Wilhelm 4508 m) that form a natural east-west barrier. The mountain chain is made up of a series of ranges divided by large fertile valleys at altitudes between 500 and 1800 m. High rainfall is responsible for the existence of many rivers, which are navigable only in their lower parts. Exceptions, however, are the Sepik River in the north and the Fly River in the southwest, both with extensive swamps. Southwestern Papua New Guinea is a flat land covered with dry evergreen forest (Department of Forestry 1986). It is here that Zieck (1970) and others reported stands of *Santalum macgregorii*, the Papua New Guinea species, in savannah areas.

## THE SANDALWOOD INDUSTRY IN PAPUA NEW GUINEA

The general timber industry in Papua New Guinea has the potential to become one of the mainstays of the country's economy, as a provider of employment for an increasing number of people, as a major foreign exchange earner, and as a significant source of revenue for the government. Developments in the industry over the past 30-40 years have been marked. Export of forest products has expanded from a value of A\$257,000 in 1951-52 to K82,069,900 in 1984 (table 1). This value is approximately 10 percent of the total national export earnings (Department of Forestry 1986).

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Sandalwood is classified as a minor part of the forest products industry. The resource conditions of sandalwood are very poor, and, according to some reports, the sandalwood of Papua New Guinea was nearly cut out in 1975. They go on to say that sandalwood in Papua New Guinea should be given special care by the Forestry Department and local landowners. This care can be in the form of tending and protecting still available "root suckers" against grassland savannah fires. The law protecting the stand of sandalwood in Papua New Guinea was this (Smith 1927): "It shall be unlawful for any person to cut any sandalwood tree the trunk of which at the height of 1 foot (about 30 cm) from the surface of the ground measures less in circumference than 18 inches (46 cm). A licence may be issued to any person who wishes to cut sandalwood, or collect or buy it from natives. The licence shall remain in force for six or twelve months, and may be renewed. The fee payable shall be at the rate of £2 per year."

After an expedition in southwestern Papua New Guinea, Zieck (1970) reported that survival of many younger and older *Santalum* trees in the area was due to low population density, nearly no roads, no cattle grazing, and slight fire intensity for gardening or hunting purposes. Moreover, most of the *S. macgregorii* stands are surrounded by semi-deciduous thickets, which usually lack fire-susceptible grass. Howcroft (1990), in his working paper of the Review of Information on Papua New Guinea Sandalwood, stated that little information is available on Zieck's work on the Papua New Guinea sandalwood and that research is necessary.

## EXPORT OF SANDALWOOD

Papua New Guinea's timber industry is rated as the third major revenue earner for the government, after mineral and agricultural commodities such as coffee, copra, cocoa, and palm oil. As can be seen in table 1, most of the timber revenue is earned through export of logs through major markets in Japan, South Korea, Australia, and New Zealand. Exported sandalwood is weighed in kilograms and not measured in cubic meters. According to statistics compiled by the Marketing Branch of the

Commodity	Quantity		Value		Percentage	
	1984	(1983)	1984	(1983)	Value of Total	
	thou. cubic meters		thou. Kina <sup>1</sup>			
Logs	1283.9	(1019.2)	70272.8	(44055.7)	85.6	(79.3)
Woodchips	<sup>2</sup> 102.5	<sup>2</sup> (99.9)	6137.8	(5922.5)	7.5	(10.6)
Sawn Timber	17.8	(20.1)	3322.1	(3161.2)	4.1	(5.7)
Plywood	5.1	(5.5)	2317.2	(2464.2)	2.8	(4.4)
Sandalwood	—	(0.1)	16.3	(45.6)	—	(0.1)
Veneer Flitches	—	(—)	—	(31.7)	—	(0.1)
Chopsticks	—	(0.1)	3.7	(17.0)	—	
Total	1306.8	(1045.0)	82069.9	(55697.9)	100.0	(100.0)

<sup>1</sup>Kina = US\$1.01 or AU\$1.4671 (1985).  
<sup>2</sup>Thousand bone dry units. 1 bdu = 1.546 m.<sup>3</sup>

**Table 2—Forest products exported from Papua New Guinea, 1987**

Product	Actual						Anticipated		
	1982	1983	1984	1985	1986	1987	1988	1989	1990
	<i>Thousand cubic meters</i>								
Logs Sawn	1063	1019	1283	1158	1314	1442	1507	1550	2050
Timber	21	20	18	15	7	4	10	40	50
Plywood	6	6	5	1	.2	.02	3	10	10
Woodchips	148	100	103	82	61	66	80	100	100
Total	1238	1145	1409	1256	1382	1512	1600	1700	2200
Value	53	56	82	67	77	113	126	136	176

Notes: Value is million kina at free on board price. Log exports will stabilize at around 2,000,000 m<sup>3</sup>/yr. On-shore processing will increase significantly.

Department of Forestry, 100 kg of sandalwood were produced in 1983, bringing in K45600. In 1984 the revenue earned was K16300. The data in *table 2* are also from the Marketing Branch, but sandalwood was not included for 1987 exports (Department of Forestry 1987).

From 1891 until 1980, a total of about 9,000 tonnes of sandalwood were exported. Zieck (1970) reported that sandalwood harvesting for export in later years (1962-1964) came more from inland areas. Otherwise easily accessible stands were cut down between 1890 and 1910, and probably again in 1933.

Howcroft (1990) in his working paper reported that a total of 8,150 tonnes of sandalwood were sent to Singapore and China from Port Moresby before 1971. As estimated by Zieck, a cut of 180,000 trees would have been required to supply this amount.

### Overseas Markets

The markets for sandalwood from Papua New Guinea are in Hong Kong, Singapore, Taiwan, and Japan, through intermediate merchants or entrepreneurs in Port Moresby. Through approval of the National Investment and Development Authority (NIDA), there is no restriction on the quantity of sandalwood exported. *Table 3* contains the statistics on the quantity of sandalwood exported and the amount sold for the period 1891-1976 (Zieck 1970).

### Preparing Sandalwood for Export

After sandalwood is felled it is cut into logs of about 1 meter (3-4 ft) for de-sapping. The felled log must have a heartwood diameter of 18 cm (7 inches), as cutting trees of smaller diameter is prohibited. Logs are then air dried to attain a moisture content of about 18 percent. The logs are then graded and classified into five groups: roots and stumps, crooked thin pieces (e.g., good branches), logs with holes, straight small logs, and big logs (25-37 cm; 10-15 inches) with no holes.

### Export Prices

In 1978 the price for *S. macgregorii* per tonne was K400-

K1000, while the same quantity of Indian sandalwood (*S. album*) was sold at A\$2000-5000. In 1980 Indian sandalwood was valued at £2000 per tonne (\$6000/tonne). Indian sandalwood contains 95 percent santalol, while that of Papua New Guinea contains 45 percent santalol and perhaps has a value of about a third or a quarter of the mentioned amount.

Local use of sandalwood is possible with the availability of forestry distillation equipment that can extract 3-5 percent of the santalol oil. The quality of the oil would be low, but it can be used in the local perfume industry, for example, as in manufacturing soap. With the addition of chemicals the quality can be improved, but chemicals are rather costly.

### PROBLEMS RELATED TO THE SANDALWOOD STAND IN PAPUA NEW GUINEA

The problems related to the *S. macgregorii* stand in Papua New Guinea are numerous. I will describe two of them. According to Zieck (1970, p. 2), the stand is not continuous for two reasons: "... the grassy open savannah areas are more sensitive to fire. Large tracts of semi deciduous thickest vegetation enclose many islands of open savannah forest where more sandalwood stands may be expected after more detailed investigations. And, that the light loving sandalwood seemed to avoid the thickest. In some way this could be one of the causes of the discontinued distribution."

Howcroft (1990) reported that Zieck raised sandalwood seedlings in the Brown River (west of Port Moresby), using host plant seedlings in the same pots. He successfully used guava (*Psidium guava*) as a host plant for *S. album* at Brown River but later lost the sandalwood when the guava died. Howcroft also reported that several Eucalyptus species were identified by Zieck as hosts for the local sandalwood, but there is no information to substantiate this claim.

The value of Papua New Guinea sandalwood (*S. macgregorii*) is low in comparison with Indian sandalwood (*S. album*). Therefore any artificial propagation should be with Indian stock or seed.

Year	Value	Quantity (tonnes)	Value Per Tonne	Year	Value	Quantity (tonnes)	Value Per Tonne
1891-92	£290	42.98	£6.75	1921-22	£609	19.30	£31.55
1892-93	7183	913.49	7.86	1922-23	282	11.17	25.24
1893-94	1896	326.14	5.81	1923-24	585	18.28	32.00
1894-95	2568	384.86	6.67	1924-25	666	15.24	43.70
1895-96	4035	533.21	7.56	1925-26	250	5.08	49.02
1896-97	2323	305.06	7.61	1926-27	240	6.09	39.40
1897-98	2940	309.27	9.50	1927-28	424	21.33	19.87
1898-99	2290	312.11	7.34	1928-29	225	3.05	73.77
1899-1900	8698	737.66	11.79	1929-30	2779	99.06	28.05
1900-01	2957	208.46	14.18	1930-31	716	28.45	25.51
1901-02	8353	642.26	13.00 <sup>1</sup>	1931-32	2,523	93.21	27.07
1902-03	4494	361.84	12.41	1932-33	536	25.65	20.89
1903-04	8382	599.94	13.97	1933-34	2699	105.15	25.66
1904-05	7873	489.10	16.10	1934-35	5,548	174.50	31.79
1905-06	2522	213.75	11.80	1935-36	268	8.38	31.98
1906-07	3932	276.29	14.23	1936-37	85	7.11	11.95
1907-08	6346	427.73	15.00 <sup>1</sup>				
1908-09	2701	204.50	13.20				
1909-10	4628	308.52	15.00 <sup>1</sup>				
1910-11	190	15.54	12.20	1962-63 <sup>2</sup>	4934	30.73	160.53
1911-12	259	173.26	15.00 <sup>1</sup>	1963-64	13,493	78.99	170.82
1912-13	74	5.00	15.00 <sup>1</sup>	1964-65	3528	18.99	185.78
1913-14	85	5.66	15.00 <sup>1</sup>				
1914-15	1363	54.52	25.00 <sup>1</sup>	1972-73 <sup>2</sup>	\$800	3.13	\$256.00
1915-16	1416	52.83	26.80	1973-74	638	1.45	440.00
1916-17	633	25.40	24.52	1974-75			
1917-18	252	10.05	25.87	1975-76	K157,367	208.279	K755.00
1918-19	704	22.14	31.79				
1919-20	2071	31.09	66.60				
1920-21	222	4.06	54.62				
	Period 1891-92 to 1913-14 j (23 years)	Period 2 1914-15 to 1936-37 (23 years)	Period 3 1962-63 to 1964-65 (3 years)				
Value p.a.)	£85,019 (£3,696 p.a.)	£25,096 (£1,091 p.a.)	£21,955 (£7,318 p.a.)				
Quantity	7640.6t (332.2 t.p.a.)	841.14t (36.6 t.p.a.)	128.71t (42.95 p.a.)				
Value/ Tonne	£11.6	£33.60	£172.4				
Total for 51 years: \$265,578 (\$5207.4 p.a.); 8615.1 tonnes (168.9 t.p.a.)							
<sup>1</sup> Here statistics only mention values, so quantities were determined by an estimated value per tonne.							
<sup>2</sup> No exports from 1937-38 to 1961-62 and from 1965-66 to 1971-72.							

Sandalwood grows on the driest part of Papua New Guinea, on savannah forest and on grassland. Tending the parasite seedling is critical until it can withstand all but very hot grass fires. This need applies whether the seedling is naturally or artificially propagated. A young sandalwood stand is sensitive to fire; thus it is necessary to protect it from the yearly fire that is customary in its natural habitat—if it is to succeed.

A second problem of sandalwood in Papua New Guinea is that the government owns none of the sandalwood forest. Any remainder of the original stand is owned by a traditional land-owner.

## RECOMMENDATIONS

As mentioned earlier, sandalwood in Papua New Guinea is classified with minor forest products, together with others like rattan. Despite the value of sandalwood (*table 1*), to date neither the Forestry Department nor any other organization has shown interest in developing the sandalwood industry. This lack of interest could be due to both economic factors and to the density of the sandalwood stand in Papua New Guinea.

Howcroft (1990), who cited several publications relating to sandalwood in Papua New Guinea and who was once nominated by a former Director of Forestry, A. Yaueib, to carry out the work left by Zieck, reported that further research on Papua New Guinea sandalwood is necessary. He came up with the following recommendations before any future work is proposed and implemented:

(a) Research should be carried out to see whether any further information is available from J. Zieck's work on *Santalum*.

(b) Any available herbarium material from Papua New Guinea sandalwood should be inspected to collect information on distribution, flowering, and fruit production.

(c) Further collections should be studied by the Botany Branch for distribution records.

(d) Host plant compatibility trials should be conducted with local and introduced *Santalum* species.

(e) Fire control management trials should be implemented with native sandalwood, and growth data collected.

## CONCLUSIONS

There may be undiscovered sandalwood stands in Papua New Guinea. The only person who studied Papua New Guinea sandalwood was J. Zieck, but he did not complete his work.

Intensive studies including phenology, growth, and general silvicultural techniques for Papua New Guinea sandalwood are yet to be established.

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